Sub A'

1. A superconducting ceramic conductor for use in a preselected fluid cryogen comprising:

a composite ceramic superconducting wire having an outer surface along its length, and

a sealing structure hermetically surrounding the outer surface to prevent the cryogen from infiltrating into the wire and degrading its superconducting properties,

wherein the sealing structure comprises a cured polymer layer encircling the outside surface of the wire.

2. The conductor of claim 1 further comprising a metallic tape laminated to the composite tape, the cured polymer layer encircling the composite tape and the metallic tape.

3. The conductor of claim 1, wherein the cured polymer layer comprises conductive media.

4. The conductor of claim 3, wherein the conductive media are metallic elements dispersed within the polymer layer.

5. The conductor of claim 3, wherein the wire is a composite superconducting tape having a thickness and wherein the conductive media permit the polymer layer to be conductive at least along a direction parallel to the thickness of the composite tape.

6. The conductor of claim 1, wherein the wire is a composite ceramic superconducting tape having a top face, a bottom face, and side faces, and wherein the outer surface is the top, bottom, and side faces.

7. The conductor claim 1, wherein the wire and surrounding sealing structure are greater than 50 meters long.

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8. The conductor of claim 1, wherein the wire comprises a metallic matrix supporting a plurality of superconducting ceramic filaments.

9. The conductor of claim 1, wherein the wire comprises at least one superconducting ceramic layer and at least one metallic substrate supporting the at least one superconducting ceramic layer.

10. The conductor of claim 1, wherein the sealing structure prevents the cryogen from infiltrating into the wire through the outer surface under pressurized conditions.

11. The conductor of claim 10, wherein the pressurized conditions exceed about 10 atm and the fluid cryogen is liquid nitrogen.

12. A superconducting conductor for use in a preselected fluid cryogen, comprising:

a composite ceramic superconducting wire having an outer surface surrounding the wire along its length; and

a sealing structure hermetically surrounding the outer surface permitting the superconducting ceramic conductor to withstand thermal cycling in which the fluid cryogen is under pressurized conditions without degrading the current carrying capability of the superconducting ceramic tape by more than 10%,

wherein the sealing structure comprises a cured polymer layer encircling the outside surface of the wire.

13. The conductor of claim 12, wherein the pressurized conditions exceed about 2 bar and the fluid cryogen is liquid nitrogen.

14. A superconducting cable, comprising a superconducting ceramic conductor according to claim 1.

15. A superconducting coil, comprising a superconducting ceramic conductor according to claim 1.

16. The conductor of claim 1, wherein the cured polymer layer has an ultimate tensile strength of at least about 100-160 MPa at 77 K.

17. The conductor of claim 1, wherein the cured polymer layer has an elongation of at least about 0.3% to 0.5% at 77 K.

18. The conductor of claim 1, wherein the cured polymer layer has an ultimate tensile strength of at least about 100-160 MPa at 77 K and an elongation of at least about 0.3% to 0.5% at 77 K.

19. A method of making a superconducting conductor for use in a preselected fluid cryogen, the method comprising:

providing a composite ceramic superconducting wire having an outer surface along its length; and

hermetically surrounding the outer surface with a sealing structure to prevent the cryogen from infiltrating into the wire and degrading its superconducting properties, by forming a polymer coating completely covering the outer surface of the wire.

20. The method of claim 19, wherein the provided wire is formed by at least one sequence of a mechanical deformation and a subsequent heat treatment of a container comprising superconducting ceramic precursor.

21. The method of claim 19, wherein the

hermetically surrounding step comprises laminating a metallic tape to the wire.

22. The method of claim 19, further comprising adding conductive media to the polymer coating prior to covering the outer surface of the wire.

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